

5. WASTE MANAGEMENT

5.1 Introduction

- 5.1.1 This section identifies the potential wastes arising from the construction of the Route 16 Alternative Alignment and provides an assessment of the potential environmental impacts associated with the handling and disposal of these wastes.
- 5.1.2 As presented in *Section 2*, there are no changes for the Alternative Alignment beyond the Eagle's Nest Tunnel when compared with the Conforming Alignment. It is therefore agreed that the findings and conclusions of the waste management impacts assessment for the Sha Tin Section, which has been undertaken in the previous *Route 16 Investigation Assignment EIA Study*¹, are still applicable to this Study.
- 5.1.3 It is anticipated that only a small amount of waste will be generated during the operational phase of the Route 16. It is therefore concluded that the potential environmental impacts associated with waste management during the operational phase will not be a concern and hence a detailed waste management impact assessment is not required.
- 5.1.4 The options for reuse, minimisation, recycling, treatment, storage, collection, transport and disposal of wastes arising from the Project have been examined. Where appropriate, procedures for waste reduction and management are considered and environmental control measures for avoiding and minimising the potential impacts are recommended.

5.2 Environmental Legislation and Standards

Legislation

- 5.2.1 The following legislation covers or has some bearing upon the storage, collection, treatment and disposal of the wastes arising from the Project:
- Waste Disposal Ordinance (Cap 354);
 - Waste Disposal (Chemical Waste) (General) Regulation (Cap 354);
 - Land (Miscellaneous Provisions) Ordinance (Cap 28);
 - Public Health and Municipal Services Ordinance (Cap 132) - Public Cleansing and Prevention of Nuisances (Urban Council) and (Regional Council) By-laws; and
 - Dumping at Sea Ordinance (Cap. 466).

Guidelines

- 5.2.2 Other 'guideline' documents which detail how the Contractor should comply with the regulations of the Hong Kong SAR are as follows:
- *Waste Reduction Framework Plan, 1998 to 2007*, Planning, Environment and Lands Bureau, Government Secretariat (5 November 1998);
 - *Environmental Guidelines for Planning In Hong Kong (1990)*, Hong Kong Planning and Standards Guidelines, Hong Kong Government;

¹ *Route 16 from West Kowloon to Sha Tin Investigation Assignment - EIA Study, Final Assessment Report, Jan 1998, ERM*

- *New Disposal Arrangements for Construction Waste (1992)*, Environmental Protection Department & Civil Engineering Department;
- *Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes (1992)*, Environmental Protection Department;
- *Works Branch Technical Circular No. 6/92, Fill Management*;
- *Works Branch Technical Circular No. 2/93, Public Dumps*;
- *Works Branch Technical Circular No. 16/96, Wet Soil in Public Dumps*; and
- *Works Bureau Technical Circular No. 5/98, On-site Sorting of Construction Waste on Demolition Site*.

5.3 Assessment Methodology

General

5.3.1 The potential environmental impacts due to the management of the wastes arising from the Project will be assessed in accordance with the criteria presented in *Annexes 7 and 15* of the EIAO-TM and are summarized as follows:

- estimation of the types and quantities of the wastes to be generated;
- assessment of the secondary environmental impacts due to the management of waste with respect to potential hazards, air and odour emissions, noise, wastewater discharges and traffic; and
- assessment of the potential impacts on the capacity of waste collection, transfer and disposal facilities.

5.4 Construction Waste Impact

Potential Sources of Impact

5.4.1 The Alternative Alignment will involve the construction of the following main structures:

- an approximately 700m long, dual-3 viaduct from Lai Wan Interchange to South of Wai Man Tsuen. The viaduct will pass over the existing Lai Chi Kok Interchange.
- an approximately 650m long, dual-3 viaduct from Wai Man Tsuen to Eagle's Nest Tunnel Portal. The viaduct will pass over the existing Ching Cheung Road and Wai Man Tsuen.
- an approximately 2,000m long, dual-3 tunnel through the Eagle's Nest Hill to the western end of the Sha Tin Section. After emerging from the tunnel the route follows closely that of the Conforming Scheme.

5.4.2 The construction activities to be carried out for the proposed developments will result in the generation of a variety of wastes which may include:

- site clearance waste;
- excavated materials;
- construction and demolition (C&D) waste;
- chemical waste; and

- general refuse.

5.4.3 If not properly managed, the handling and disposal of these wastes may cause adverse environmental nuisance and impacts. The nature of each of these wastes are discussed below.

Site Clearance Waste

5.4.4 The West Kowloon Section will largely consist of viaducts which will require limited site clearance works. As the Alternative Alignment runs from built area to hillside, the site clearance waste to be generated is expected to be mainly consisted of small amount of general refuse, concrete and vegetation such as trees, scrubs and grass.

Excavated Materials

5.4.5 The majority of the excavated materials will be generated from the following activities:

- widening of the Ching Cheung Road;
- construction of the foundations for the viaducts;
- earthworks at the Butterfly Valley; and
- excavation of the Eagle's Nest Tunnel.

5.4.6 The excavated materials will mainly consist of rocks, although some soils will be generated from the excavation of portals and pier foundations. These excavated materials are inert in nature and should be uncontaminated, and hence could be reused on site as fill materials.

Construction and Demolition Waste

5.4.7 Construction and demolition (C&D) material² will mainly arise from the construction of viaducts, administration buildings, tunnel portals, and the demolition of existing structures such as village houses. It comprises unwanted materials generated during the construction, including rejected structures and materials, materials which have been over-ordered and materials which have been used and discarded. C&D material may include:

- wood from formwork and falsework;
- materials and equipment wrappings;
- unusable/surplus concrete/grouting mixes; and
- damaged/contaminated/surplus construction materials.

5.4.8 It is expected that the viaducts will be constructed using the pre-casting method, majority of the C&D material will be generated at the main worksite area at the Butterfly Valley.

5.4.9 A limited number of village houses at Mui Kong Tsuen Village area may need to be demolished which will result in the generation of small quantity of C&D material.

Chemical Waste

² "C&D material" contains a mixture of inert and non-inert material. The inert portion is the "public fill" and the non-inert portion is the "C&D waste".

5.4.10 Chemical waste, as defined under the *Waste Disposal (Chemical Waste)(General) Regulation*, includes any substance being scrap material, or unwanted substances specified under *Schedule 1* of the *Regulation*. A complete list of such substances is provided under the *Regulation*, however substances likely to be generated from construction activities will, for the most part, arise from the maintenance of equipment. These may include, but need not be limited to the following:

- scrap batteries or spent acid/alkali from their maintenance;
- used engine oils, hydraulic fluids and waste fuel;
- spent mineral oils/cleaning fluids from mechanical machinery; and
- spent solvents/solutions, some of which may be halogenated, from equipment cleaning activities.

5.4.11 Majority of the chemical waste will be generated at the main worksite at Butterfly Valley. Chemical waste may pose adverse environmental, health and safety hazards if it is not properly managed. These hazards may include:

- toxic effects to workers;
- adverse effects on water quality from spills;
- fire hazards; and
- disruption of sewage treatment works where the chemical waste enters the sewerage system.

General Refuse

5.4.12 It is estimated that a maximum of 350 workers will be working on-site during the peak construction period. General refuse including paper and food waste will be generated from the worksites. Majority of the waste will be generated from the main worksite at the Butterfly Valley. The storage, handling and disposal of general refuse have the potential to give rise to adverse environmental impacts if not properly managed. These include odour if waste is not collected frequently, windblown litter, water quality impacts if waste enters water bodies, and visual impact. These worksites may also attract pests and vermin if the waste storage areas are not well maintained and cleaned regularly. In addition, disposal of waste at sites other than approved waste transfer or disposal facilities, can also lead to similar impacts.

5.5 Evaluation of Impacts

5.5.1 The construction of Route 16 is scheduled to commence in September 2001 and finish by the end of April 2005. The amount of waste arising from the construction activities and the potential environmental impacts associated with the handling, storage, transport and disposal of these wastes are discussed below.

Site Clearance Waste

5.5.2 The majority of the West Kowloon Section are either in the form of viaducts or tunnel, the amount of site clearance works will be limited. The site clearance waste is expected to consist of general refuse, concrete and vegetation. It is considered that the handling and disposal of small amount of the site clearance waste will not be a key issue and the potential environmental impacts associated with the handling and disposal of site clearance waste will be negligible, subject to the implementation of the recommended mitigation measures in *Section 5.6*.

Surplus Excavated Material

- 5.5.3 With respect to the nature and scale of the excavated works, the majority of the excavated material will arise from the earthworks at Butterfly Valley and excavation of the Eagle's Nest Tunnel.
- 5.5.4 It is estimated that about 261,500 m³ and 343,000m³ excavated materials will be generated from the West Kowloon Section works and the excavation of the Eagle's Nest Tunnel, respectively. A total of 508,900 m³ of general fill will be required for the West Kowloon works. There will be a surplus of about 95,600m³ of excavated material to be disposed off-site.
- 5.5.5 The majority of the excavated materials will be reused on-site as fill materials for site formation and construction of road embankments. With respect to the proposed construction programme, the cut and fill activities will be co-ordinated so that the need for on-site storage of fill material will be minimised. Should on-site stockpiling of fill material be required, the quantity of material stored will be minimal. The temporary stockpiling areas will be located at the Butterfly Valley. However, to eliminate the risk of the excavated materials falling into the existing nullah and blocking this main drainage channel during the wet season, it is proposed that stockpiling of excavated materials at Butterfly Valley during wet season should be avoided as far as practicable. Mitigation measures to control surface runoff from the temporary stockpiling area have been recommended in Section 5.6.7. As the Sha Tin Section will also have a surplus of excavated material, the surplus excavated materials from the West Kowloon Section will be transported off-site and reused as fill materials for other reclamation projects or public filling areas (PFAs). Opportunities of re-using of these surplus excavated materials at nearby sites should be explored during the detailed design stage in order to reduce impacts due to cross-district traffic. An exiting track connecting to Ching Cheung Road will be extended along the Butterfly Valley and used as the haul road for the West Kowloon Section (see *Figure 5.5a*).
- 5.5.6 The excavation work will be carried out between June 2002 and March 2003 (approximately 9 months). Assuming the surplus material will be delivered off-site during this period, the average quantity of surplus excavated material to be delivered off-site will be about 360m³d⁻¹. Based on a payload of 6.7m³ per truck, the additional traffic to be generated due to off-site transportation of excavation material will be about 54 truck trips per day (or 4-5 truck trips per hour assuming 12 working hours per day). It is considered that this small volume of traffic will not cause an adverse impact to the traffic flow of Ching Cheung Road.
- 5.5.7 The potential noise and water quality impacts due to on-site storage and off-site transportation of surplus excavated material have been evaluated in *Sections 4 and 6* respectively. The potential air quality impacts due to the emission of dust from the haulage of excavated materials by trucks are expected to be minimal due to the small number of traffic (about 4-5 trucks load per hour). Provided the mitigation measures suggested in *Section 5.6* are carried out, the potential dust impacts are expected to be minimal.

Construction and Demolition Waste

- 5.5.8 **Construction of New Road and Building:** The quantity of C&D material arising from the construction of the proposed route cannot be determined at this stage as it will be highly dependent on the operating procedures and site practices. The average percentage of inert and non inert materials in C&D material generated from roadworks are 96% and 4% respectively and the C&D waste generated from general construction work is approximately 11% of the total amount of concrete used (Source: *Review of the Public Fill Programme, Final Report*, Mouchel Asia Limited, 1998). It is suggested that approximately 61,500 m³ and 24,000 m³ of concrete will be used for the construction of Lai Chi Kok Viaduct and Ching Cheung Road slip road. According to the average wastage level of 11% as suggested above, it is estimated the total C&D waste will be about 9,400m³. As pre-casting method will

be used for the construction of viaducts, most of the C&D materials will be generated at the main worksite at Butterfly Valley. Standard formworks should be used for the pre-casting works which will minimise the quantity of C&D material to be generated.

- 5.5.9 **Demolition of Old Buildings:** About 20 squatter huts at the Mui Kong Tsuen Village area will need to be demolished. The quantity of C&D material arising from the demolition of these temporary structures cannot be determined as structural drawings not available, however, the total quantity should be limited (from only 20 squatter huts). The C&D material will consist of bricks, concrete slab, woods, corrugated tin sheetings and general refuse. On-site sorting of these materials will be required prior to re-use and disposal.
- 5.5.10 C&D material should be sorted at worksites before disposing of inert materials (public fill) at public filling areas and non-inert or putrescible materials (wood, paper, plastic, etc), ie C&D waste at landfills. C&D material should be removed from site as soon as practicable to avoid adverse environmental impacts due to on-site storage of the material. On-site sorting and segregation should be carried out at the main worksite at the Butterfly Valley.
- 5.5.11 To conserve void space at landfill sites, C&D waste with more than 20% (by volume) inert material (dust, dirt, soil, brick, ceramic tile, concrete, etc) should not be disposed of at landfills.

Chemical Waste

- 5.5.12 It is difficult to quantify the amount of chemical waste which will arise from the construction activities since it will be highly dependent on the Contractor's on-site maintenance intentions and the numbers of plant and vehicles utilised. However, it is anticipated that the quantity of chemical waste, such as lubricating oil and solvent, produced from plant maintenance will be relatively small (about a few hundred litres per month). These types of waste will be readily accepted at the Chemical Waste Treatment Centre at Tsing Yi. Waste oil could also be delivered to other licensed facilities for recycling.
- 5.5.13 Storage, handling, transport and disposal of chemical waste should be arranged in accordance with the *Code of Practice on the Packaging, Labelling and Storage of Chemical Waste* published by the EPD. Provided that this occurs, and the chemical waste is disposed of at a licensed chemical waste treatment and disposal facility, the potential environmental impacts arising from the storage, handling and disposal of a small amount of chemical waste generated from the construction activities will be negligible.

General Refuse

- 5.5.14 It is estimated that there will be about 350 workers working on-site during the peak construction period. The quantity of general refuse to be generated from the construction workforce is estimated to be about 210 kg d⁻¹. Provided good practice with respect to storage, transport and disposal as presented in *Section 5.6* is adhered to and the refuse is disposed of to licensed landfills, the potential environmental impacts will be minimal.

5.6 Mitigation Measures

Introduction

- 5.6.1 This section sets out recycling, storage, transportation and disposal measures which are recommended to avoid or minimise potential adverse impacts associated with waste arising from the construction of the West Kowloon Section. The Contractor should incorporate these recommendations into a on-site waste management plan for the construction works. Such a management plan should incorporate site specific factors, such as the designation of areas for the segregation and temporary storage of reusable and recyclable materials.

- 5.6.2 It is the Contractor's responsibility to ensure that only approved licensed waste collectors are used and that appropriate measures to minimise adverse impacts, including windblown litter and dust from the transportation of these wastes are employed. In addition, the Contractor must ensure that all the necessary waste disposal permits are obtained.

Waste Management Hierarchy

- 5.6.3 The various waste management options can be categorised in terms of preference from an environmental viewpoint. The options considered to be more preferable have the least impacts and are more sustainable in the longer term. Hence, the hierarchy is as follows:

- avoidance and minimisation, ie not generating waste through changing or improving practices and design;
- reuse of materials, thus avoiding disposal (generally with only limited reprocessing);
- recovery and recycling, thus avoiding disposal (although reprocessing may be required); and
- treatment and disposal, according to relevant laws, guidelines and good practice.

- 5.6.4 This hierarchy should be used to evaluate waste management options, thus allowing maximum waste reduction and often reducing costs. Waste reduction measures should be introduced at the detailed design stage and carried through the construction activities, wherever possible, by careful purchasing control, reuse of formworks and good site management. By reducing or eliminating over-ordering of construction materials, waste is avoided and costs are reduced both in terms of purchasing of raw materials and in disposing of wastes.

- 5.6.5 Training and instruction of construction staff should be given at the site to increase awareness and draw attention to waste management issues and the need to minimise waste generation. The training requirement should be included in the site waste management plan.

Storage, Collection and Transport of Waste

- 5.6.6 Permitted waste hauliers should be used to collect and transport wastes to the appropriate disposal points. The following measures to minimise adverse impacts should be instigated:

- handle and store wastes in a manner which ensures that they are held securely without loss or leakage, thereby minimising the potential for pollution;
- use waste hauliers authorised or licensed to collect specific category of waste;
- remove wastes on a daily basis;
- maintain and clean waste storage areas daily ;
- minimise windblown litter and dust during transportation by either covering trucks or transporting wastes in enclosed containers;
- obtain the necessary waste disposal permits from the appropriate authorities, if they are required, in accordance with the *Waste Disposal Ordinance (Cap 354)*, *Waste Disposal (Chemical Waste) (General) Regulation (Cap 354)*, the *Land (Miscellaneous Provisions) Ordinance (Cap 28)*;
- Dispose of waste at licensed waste disposal facilities;

- Develop procedures such as a ticketing system to facilitate tracking of loads, particularly for chemical waste, and to ensure that illegal disposal of wastes does not occur; and
- Maintain records of the quantities of wastes generated, recycled and disposed.

Surplus Excavated Material

- 5.6.7 The excavated material may have to be temporarily stockpiled on-site for subsequent re-use. Control measures should be taken at the stockpiling area to prevent the generation of dust and pollution of stormwater channels. However, to eliminate the risk of excavated materials falling into the existing nullah and blocking the main drainage channel in Butterfly Valley during the wet season, it is recommended that stockpiling of excavated materials at Butterfly Valley during wet season should be avoided as far as practicable. In addition, due to the high risk of loose material being washed into the existing nullah, stockpiled materials should be properly compacted and covered from water erosion and located at least 10m away from the nullah wall. Details of environmental control measures for water pollution are discussed in *Sections 6*. Key control measures are highlight below:

Dust:

- wetting the surface of the stockpiled soil with water when necessary especially during the dry season;
- covering the stockpiled soil with sheets;
- minimising disturbance of the stockpiled soil; and
- enclosure of the stockpiling area.

Water Quality:

- installation of silt traps for the surface water drainage system; and
- covering stockpiled material with tarpaulin during heavy rainstorm.

- 5.6.8 In addition, potential dust impacts due to the haulage of excavated materials should be minimised by undertaking the following control measures:

- dropping heights for excavated materials should be controlled to a practical height to minimize the fugitive dust arising from unloading;
- materials should not be loaded to a level higher than the side and tail boards, and should be dampened or covered before transport;
- the travelling speed should be reduced to 10 km hr⁻¹ to reduce dust dispersion and re-suspension from the operating haul trucks;
- wheel washing facilities should also be installed and used by all vehicles leaving the site.

Construction & Demolition Waste

- 5.6.9 In order to minimise waste arisings and to keep environmental impacts within acceptable levels, the environmental control measures described below should be adopted.
- 5.6.10 Careful design, planning and good site management can minimise over-ordering and generation of waste materials such as concrete, mortars and cement grouts. The design of formwork should maximise the use of standard wooden panels so that high reuse levels can be achieved. Alternatives such as steel formwork or plastic facing should be considered to increase the potential for reuse.

- 5.6.11 The Contractor should recycle as much of the C&D material as possible on-site. Proper segregation of wastes on site will increase the feasibility of certain components of the waste stream by the recycling contractors. For example, concrete and masonry can be used as general fill and steel reinforcement bar can be used by scrap steel mills. Different areas of the main worksite should be designated for such segregation and storage.
- 5.6.12 The handling and disposal of bentonite slurries should be undertaken in accordance with *ProPECC PN 1/94* on construction site drainage.
- 5.6.13 Construction and demolition wastes currently comprise approximately 35% of waste inputs to landfills. To maximise landfill life, Government policy discourages the disposal of C&D wastes with more than 20% inert material (by volume) at landfill. Inert C&D material (public fill) are directed to reclamation areas, where they have the added benefit of offsetting the need for removal of materials from borrow areas for reclamation purposes or to an approved public filling areas (PFAs). Due to limited space at landfills, disposal at reclamation sites or approved PFAs would be the preferred method. The Contractor should contact the Civil Engineering Department for details of available public filling areas. Only when recycling is not feasible on technical and/or economic grounds should the Contractor dispose of the wastes at an approved landfill site.
- 5.6.14 Government has established a charging scheme for the disposal of waste to landfill. When it is implemented, this will provide additional incentive to reduce the volume of waste generated and to ensure proper segregation of wastes to allow free disposal of inert material to public filling areas

Chemical Waste

- 5.6.15 For those processes which generate chemical waste, it may be possible to find alternatives which generate reduced quantities or even no chemical waste, or less dangerous types of chemical waste.
- 5.6.16 Chemical waste that is produced, as defined by *Schedule 1 of the Waste Disposal (Chemical Waste) (General) Regulation*, should be handled in accordance with the *Code of Practice on the Packaging, Handling and Storage of Chemical Wastes* as follows.
- 5.6.17 Containers used for the storage of chemical wastes should:
- be suitable for the substance they are holding, resistant to corrosion, maintained in a good condition, and securely closed;
 - have a capacity of less than 450 litres unless the specifications have been approved by the EPD; and
 - display a label in English and Chinese in accordance with instructions prescribed in *Schedule 2 of the Regulations*.
- 5.6.18 The storage area for chemical wastes should:
- be clearly labelled and used solely for the storage of chemical waste;
 - be enclosed on at least 3 sides;
 - have an impermeable floor and bunding, of capacity to accommodate 110% of the volume of the largest container or 20% by volume of the chemical waste stored in that area, whichever is the greatest;
 - have adequate ventilation;

- be covered to prevent rainfall entering (water collected within the bund must be tested and disposed as chemical waste if necessary); and
- be arranged so that incompatible materials are adequately separated.

5.6.19 Disposal of chemical waste should:

- be via a licensed waste collector; and
- be to a facility licensed to receive chemical waste, such as the Chemical Waste Treatment Facility which also offers a chemical waste collection service and can supply the necessary storage containers; or
- be to a reuser of the waste, under approval from the EPD.

5.6.20 The Centre for Environmental Technology operates a Waste Exchange Scheme which can assist in finding receivers or buyers for the small quantity of chemical waste to be generated from the project. The Contractor should obtain the Centre's assistance if necessary.

General Refuse

5.6.21 General refuse should be stored in enclosed bins or compaction units separate from C&D and chemical wastes. A reputable waste collector should be employed by the Contractor to remove general refuse from the site, separately from C&D and chemical wastes, on a regular basis to minimise odour, pest and litter impacts. Burning of refuse on construction sites is prohibited by law.

5.6.22 General refuse is generated largely by food service activities on site, so reusable rather than disposable dishware should be used if feasible. Aluminium cans are often recovered from the waste stream by individual collectors if they are segregated or easily accessible, so separate labelled bins for their deposit should be provided if feasible.

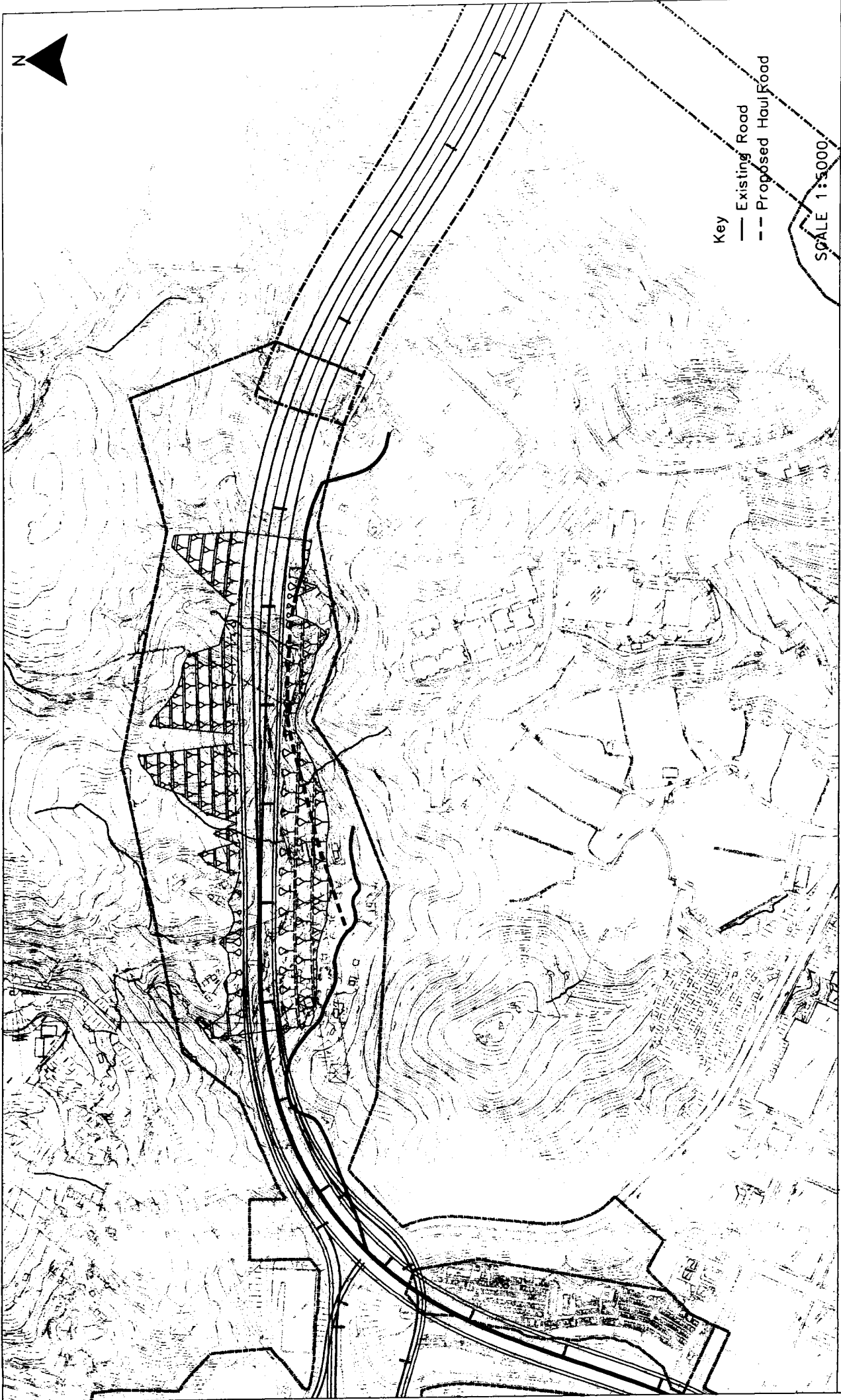
5.6.23 Office wastes can be reduced through recycling of paper if volumes are large enough to warrant collection. Participation in a local collection scheme should be considered if one is available.

5.7 Environmental Monitoring and Audit Requirements

5.7.1 It is recommended that auditing of each waste stream should be carried out periodically to determine if wastes are being managed in accordance with approved procedures and the site waste management plan. The audits should look at all aspects of waste management including waste generation, storage, recycling, treatment, transport and disposal. An appropriate audit programme would be to undertake a first audit at the commencement of the construction works, and then to audit monthly thereafter. Commencement of the construction works should be defined as the commencement of any related physical activity undertaken within the site boundary.

5.8 Conclusions

5.8.1 The potential environmental impacts with the handling and disposal of waste arising from the construction of West Kowloon Section of the Route 16 have been assessed. Operational impacts on the proposed route are not expected to be a key concern and no detailed assessment will be required. Key issues include the need for effective waste management planning during the construction phase. The assessment has concluded that the potential environmental impacts associated with the handling, storage, treatment and disposal of waste arising for the construction of Route 16 Alternative Alignment meet the requirements of the EIAO-TM.



Key
— Existing Road
-- Proposed Haul Road

SCALE 1:5000

FIGURE 5.50

PROPOSED HAUL ROAD FOR WEST KOWLOON SECTION